



## Personal Ice Cooling System (PICS)

### *The Challenge*

The Hanford Site is located in a semi arid region of Washington State where summer temperatures can exceed 100 degrees F. Many of the operations, maintenance, upgrade and remediation tasks are situated outdoors where various types and layers of anti-contamination clothing are required. Such personnel protective equipment (PPE) protects the workers from contamination, but can significantly compromise the body's ability to cool itself. For this reason, controlling heat stress is important from a project management perspective because shortened stay-times can also lead to a delay in the completion of field activities. Heat stress control is also of paramount importance from a health and safety perspective because of the seriousness of heat stress-related illnesses. The challenge is to minimize heat stress while providing optimum worker comfort, protection and greater stay-time in the field.



Example of PICS vest, shirt, pant and hood undergarments. Chilled water and pump pack are worn around the waist.

### *Current Approach*

Current methods for protecting workers from unacceptable temperature extremes during the hot summer months include limiting the time spent in radiation zones, providing extended and extra work breaks, beverage supplements and wearing hoods with supplied conditioned air via umbilical tubes. These methods each have limitations and are less than ideal (i.e., they don't last long enough, are awkward, inefficient or require a combination of methods to satisfy worker protection). The current heat stress program at Hanford also employs physiological monitoring and use of air-conditioned cool down rooms where available.

### *New Technology*

The Personal Ice Cooling System (PICS) is a self-contained, core-body-temperature control system that uses ordinary ice as a coolant and circulates cool water through tubing that is incorporated into durable and comfortable, full-body garments (e.g., pants, shirts, vests and hoods). Water is frozen in bottles that are worn outside or inside of PPE clothing in a sealed, insulated bag, with a circulating pump attached to a support harness system. The use of a rate-adjustable, battery-powered pump circulates the chilled water through the small diameter tubes sewn into the garments. The adjustable pump allows

#### *Benefits and Features*

- ◆ Ensures safer body temperatures
- ◆ Increases worker well-being, comfort and productivity
- ◆ Increases stay-times, thus reducing cost and accelerating schedules

the worker to control his temperature based on the environment and his workload. The combined weight of the ice bottle, pump and suit is only about twelve pounds. The torso portion of the suit can be worn with a hood and pants, depending on the amount of cooling needed. The garment is worn under the first layer of PPE and is considered personal clothing – it can be laundered normally.

### *Demonstration Description*

During late spring of 1999, about ten PICS suits were provided to the Hanford Site as part of a promotion sponsored by the vendor and DOE's Office of Science and Technology (EM-50). The vendor and an experienced "user" and contract employee from Fluor Daniel Fernald also visited Hanford to provide briefings on the benefits and proper use of the PICS. The briefings were attended by safety representatives from most of the Hanford contractors. During the high temperature months of July, August and September 1999, a number of field tasks were selected for trial application of the PICS. Most trials were in support of field activities within or near Hanford's tank farms (e.g., SX Tank Farm borehole drilling, hot water additions for waste tank flushing, etc.). While a formal report was not issued on the specific results of the field activities at Hanford, feedback on the field trials was relayed through project safety organization representatives.

### *Demonstration Results*

The general feedback received from the field operations staff indicated that the vests did

indeed provide additional comfort, and that workers were able to perform scheduled work activities for longer periods before needing rest. On nearly all jobs, the ice in an individual bottle lasted between 1-2 hours.

A controlled and detailed comparison of the PICS versus baseline heat stress management techniques is documented in "Innovative Technology Summary Report – Personal Ice Cooling System (PICS), DOE/EM-0393," which can be accessed via website <http://OST.em.doe.gov> under "Publications."

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